CBO TESTIMONY

Statement of
J. Michael Gilmore
Assistant Director

The Army's Future Combat Systems Program

before the
Subcommittee on Tactical Air and Land Forces
Committee on Armed Services
U.S. House of Representatives

April 4, 2006

This document is embargoed until it is delivered at 2 p.m. (EDT) on Tuesday, April 4, 2006. The contents may not be published, transmitted, or otherwise communicated by any print, broadcast, or electronic media before that time.

CONGRESSIONAL BUDGET OFFICE
SECOND AND D STREETS, S.W.
WASHINGTON, D.C. 20515

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
04 APR 2006		**00-00-2006 to 00-00-2006**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
CBO Testimony. The Army's Future Combat Systems Program	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Congressional Budget Office,Ford House Office Building 4th Floor,Second and D Streets, SW,Washington,DC,20515-6925**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**23**	

Mr. Chairman, Congressman Abercrombie, and Members of the Subcommittee, I appreciate the opportunity to appear before you today to discuss the Army's Future Combat Systems (FCS) program and possible alternative approaches to modernizing the Army's forces. My statement is based on a forthcoming Congressional Budget Office (CBO) study that was requested by Mr. Abercrombie.

CBO's analysis of the FCS program and potential alternatives supports the following observations:

- The FCS program must surmount substantial technical and funding challenges if it is to develop and initially field all of the individual FCS components as currently scheduled—by December 2014.

- According to the Army's estimates, total annual costs to purchase the various FCS components could approach $10 billion.[1] However, if such costs grew as those of similar programs have in the past, annual costs could reach $16 billion.

- Moreover, if the Army fields FCS vehicles according to its current schedule, more than $2 billion of additional funding could be needed annually from 2010 through 2016—with lesser amounts required thereafter—to maintain and upgrade the Army's inventory of aging ground combat systems.

- Although one of the main purposes of the FCS program is to speed the movement of Army combat units overseas, replacing the current fleet of armored vehicles with FCS vehicles will not significantly reduce deployment times.

- Alternatives to the currently planned FCS program that would eliminate all or part of the program's ground vehicles while retaining its communications equipment and, in some cases, its sensors would reduce the program's annual costs to about $6 billion to $7 billion. Under such alternatives, the Army would incorporate some of those technologies into its current armored vehicles and upgrade those vehicles at the same time, thereby increasing their capabilities and extending their useful lives. However, if it did so, the Army would forgo the potential benefits of the capabilities it now seeks in the FCS program.

The Future Combat Systems Program

The FCS program was first conceived by then-Army Chief of Staff General Eric Shinseki as a way to enable Army units to react to overseas crises quickly and with overwhelming combat power. Units with significant firepower—so-called heavy units—can take weeks to deploy overseas. By contrast, light units lack heavy weapons but can be transported quickly. To correct those deficiencies, the Army initiated the FCS program to develop a new generation of combat vehicles that

1. Unless otherwise noted, costs in this testimony are presented as 2006 dollars, and all years are fiscal years.

would be as lethal and survivable as current heavy weapons but weigh much less and require far less logistical support.

Description of the Program

The FCS program would, according to the Army, greatly enhance the capability and agility of its heavy units and also make them less reliant on support from other units. It would do so by developing new systems to replace most of the combat vehicles in the service's heavy units and by developing and buying several types of unmanned air and ground vehicles to provide remote—and sometimes autonomous—surveillance and protection. Specifically, the FCS program would develop eight new types of armored vehicles, four classes of unmanned air vehicles (UAVs), three types of unmanned ground vehicles, unattended ground sensors, a missile launcher, and improved munitions, all of which would be linked by advanced communications networks into an integrated combat system.

Manned FCS Vehicles. The eight new manned vehicles in the FCS program are intended to replace the armored vehicles currently in the Army's heavy combat units (see Table 1). The eight variants would share a common chassis and engine, as well as other components, which would reduce the logistics burden associated with maintaining them. The vehicles would have new weapons, sensors, and types of protection, making them, according to the Army, more capable than current systems. The FCS vehicles are also being developed to be more fuel-efficient than the Army's current armored vehicles, some of which—notably the Abrams tank and Bradley fighting vehicle—go less than two miles on a gallon of fuel.

Initially, the FCS program aimed to develop vehicles that weighed less than 20 tons and that could be transported by the Air Force's C-130 aircraft. However, the current weight target for the initial design of the FCS program's manned ground vehicles has been set at 24 tons—which would nevertheless be about one-third of the weight of the latest model of the Abrams tank and roughly three-quarters that of the Bradley fighting vehicle.

Unmanned Aerial and Ground Vehicles. The FCS program would develop four classes of unmanned aerial vehicles and three types of unmanned ground vehicles. Those systems would provide surveillance as well as protection and cargo-carrying capacity in addition to that provided by manned systems. The aerial vehicles would have varying capabilities: the smallest, Class I, UAV would weigh less than 15 pounds, have a range of eight kilometers (km), and be able to stay aloft for one hour, whereas the largest, Class IV, UAV could weigh more than 3,000 pounds, have a range of 75 kilometers, and be able to stay aloft for up to eight hours. The other two classes of UAVs (II and III) would have intermediate weights and capabilities.

The three types of unmanned ground vehicles, or robots, in the FCS program are intended, in general, to lighten the load of individual soldiers by carrying supplies or entering areas or locations where the risk for soldiers would be high:

Table 1.

FCS Systems and Current Counterparts

Future Combat Systems	Mission	Current System Replaced
	Manned Vehicles	
Mounted Combat	Destroy the enemy	Abrams tank
Infantry Carrier	Transport and protect soldiers	Bradley infantry fighting vehicle and M113 armored personnel carrier
Reconnaissance and Surveillance	Scout	Bradley fighting vehicle
Non-Line-of-Sight Cannon	Provide fire support	M109 howitzer
FCS Recovery and Maintenance	Recover stranded vehicles	M88 recovery vehicle
Command and Control	Transport and protect commanders	M577 and M1068 (M113-based vehicles)
Non-Line-of-Sight Mortar	Provide fire support	M1064 (M113-based vehicle)
Medical	Treat and evacuate the wounded	None
	Unmanned Ground Vehicles	
Armed Robotic	Perform sentry duty; provide cover	None
Multifunction Utility and Logistics	Carry cargo; detect and counter mines	None
Small Unmanned Ground	Investigate small, confined spaces	None
	Unmanned Air Vehicles	
Class I UAV	Provide surveillance out to a distance of 8 km	None
Class II UAV	Provide surveillance out to a distance of 16 km	None
Class III UAV	Provide surveillance and communications relay out to a distance of 40 km	Shadow tactical UAV
Class IV UAV	Provide surveillance and communications relay out to a distance of 75 km	None
	Other	
Non-Line-of-Sight Launch System	Carry out precision attacks out to a distance of 70 km	None
Unattended Ground Sensors	Detect and identify intruders	REMBASS
Improved Munitions Systems	Channel enemy movement	"Smart" land mines

Source: Congressional Budget Office based on data from the Department of the Army and U.S. Army, Project Manager, Combat Systems, "Combat Systems: Where We Are..., Where We Are Going" (briefing at the National Defense Industrial Association Combat Vehicles Conference, September 22, 2005).

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle; km = kilometer; REMBASS = remotely monitored battlefield sensor system.

- The largest unmanned ground vehicle—designated the armed robotic vehicle (ARV)—would weigh slightly more than 13 tons and would come in two versions, one to support dismounted infantry and the other to provide reconnaissance. The program's goal for such robots is that they be capable of finding and attacking targets on their own.

- A utility robot, known as the multifunctional utility, logistics, and equipment vehicle, would weigh 2.5 tons—about as much as a small truck—and come in three variants: a cargo carrier, a countermine vehicle, and a lighter, smaller version of the ARV.

- A robot known as the small unmanned ground vehicle—designed, at 30 pounds, to be light enough to be carried by a soldier—would be used to investigate tunnels, caves, and other potentially dangerous locales.

Unattended Sensors, Improved Munitions, Launchers, and the Network. The remaining hardware systems in the FCS program include ground sensors, a missile launcher, improved munitions, and equipment associated with the network. The unattended ground sensors are small modules equipped with multimode sensors that are intended to provide remote-sentry capability and early warning. The improved munitions systems are sophisticated land mines that can self-destruct on command or at a specified time. Those two systems are designed to be relatively inexpensive and to detect and destroy intruders over a wide area. The non-line-of-sight launch system—a box-shaped launcher equipped with 15 advanced missiles—can be operated remotely or set for autonomous operation and is intended for the rapid-fire attack of targets at a distance of as much as 70 km.

The final component of the FCS program is the network that would enable the various systems to operate with one another and with other Army systems. The network encompasses the common operating software that would allow all of the elements of FCS to communicate with one another and share data as well as the communications and computer systems that would provide secure, reliable access to information collected by the many surveillance sensors in the future FCS-equipped brigade.

Schedule for Fielding Systems. Notwithstanding the complexity of and wide diversity among the 18 individual systems in the FCS program, the Army plans to field all of them on a very tight schedule: plans are to introduce the systems in phases, starting in 2010 with the unattended ground sensors, the non-line-of-sight launch system, and the improved munitions systems. However, the Army does not expect to field the first brigade combat team to be equipped with all 18 systems until December 2014. After that, the service plans to equip its combat brigades with FCS components at a maximum rate of 1.5 brigades per year, purchasing 15 brigades' worth of equipment as part of the first installment—or "increment"—of the FCS

program.[2] Under the current schedule, equipment for the 15th brigade would be purchased in 2023, which would allow it to be fielded in 2025.

The Cost of the Army's FCS Program. The FCS program represents by far the biggest single investment that the Army is planning to make for the next 20 years. The research and development (R&D) portion of the program is scheduled to extend through 2016 and require a total of $21 billion from 2007 to 2016. The Army estimates that total procurement costs for the first 15 brigades' worth of systems will be just over $100 billion, which translates into an average unit procurement cost of $6.7 billion per brigade.[3] With the planned purchase of 1.5 brigades per year to begin in 2015, the FCS program will require $8 billion to $10 billion annually starting in that year and for as long as the program continues yearly purchases at that rate (see Figure 1).

Concerns About the FCS Program

The Government Accountability Office (GAO) and other defense experts have identified several areas of concern about the FCS program. Among them are the technological challenges facing developers of the various systems, the costs of the program in the light of the Army's other funding needs, the condition of the service's current fleet of armored vehicles (which will be retained for several decades until they can be replaced by FCS vehicles), the limited improvement in Army units' deployability that the fielding of FCS components is designed to bring, and the survivability of FCS vehicles in hostile environments.

Technological Readiness of FCS Systems. Defense analysts have questioned whether the planned FCS components will be ready to go into production in 2012. GAO, for example, has criticized the Army's proposed schedule for developing and fielding the 18 systems; such a schedule, according to the agency, would require the development of multiple systems and a network in the same amount of time that the Department of Defense (DoD) typically takes to develop a single advanced system.[4] Yet as GAO has stated, none of the numerous technologies that are critical to developing the various FCS components—technologies that should have been "mature" before the program entered the system development and demonstration (SDD) phase in 2003—were judged to be so in an independent assessment dated

2. Procurement of FCS components is often discussed in terms of a brigade's worth of equipment, which includes more than 300 manned vehicles, approximately 240 unmanned ground vehicles, more than 100 UAV systems, and numerous additional unattended ground sensors, launch systems, and associated munitions.

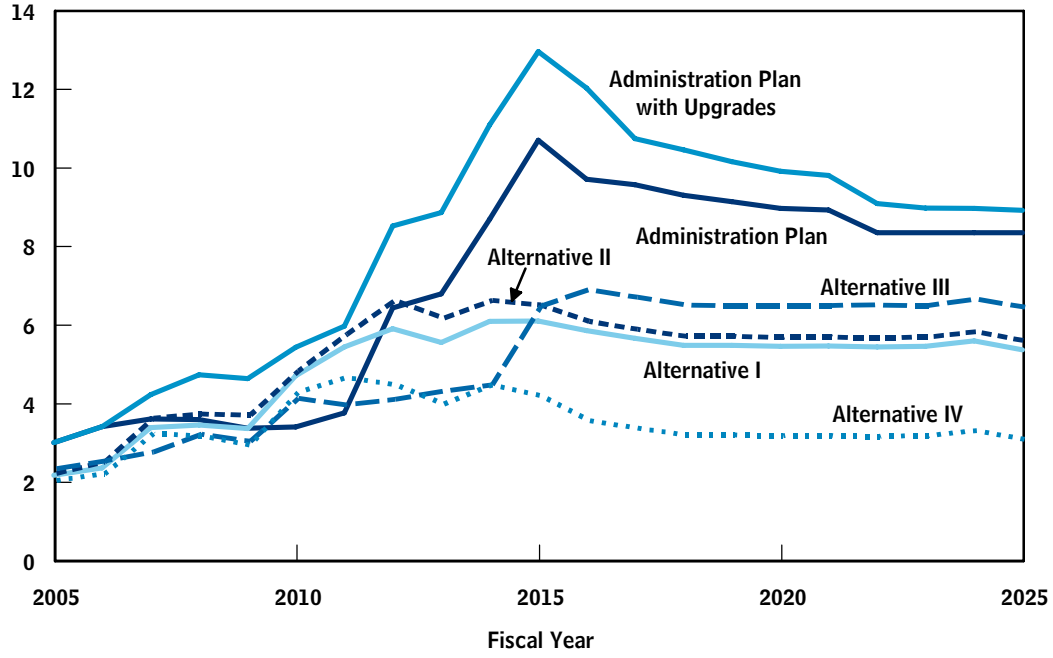
3. It is not possible to develop an independent estimate of the cost of a brigade's worth of equipment because some of the individual FCS components are not yet fully defined.

4. Statement of Paul L. Francis, Director, Acquisition and Sourcing Management, before the Subcommittee on AirLand of the Senate Committee on Armed Services, *Future Combat Systems: Challenges and Prospects for Success*, published as Government Accountability Office, *Defense Acquisitions: Future Combat Systems—Challenges and Prospects for Success*, GAO-05-442T (March 16, 2005).

Figure 1.

Annual Costs of the Administration's Plan and Alternatives

(Billions of 2006 dollars)



Source: Congressional Budget Office.

Notes: The estimated costs reflected in the figure do not account for the possibility that costs may grow as they have in similar defense programs in the past.

Alternative I would emphasize information collection and sharing;

Alternative II would emphasize long-range strike missions;

Alternative III would emphasize new vehicular technology; and

Alternative IV would cancel all vehicles, munitions, sensors, and missile launchers in the Future Combat Systems program.

April 2005.[5] Those technologies may not be mature until 2012, when the first FCS component is slated to go into production.

Another technological hurdle is development of the software that will allow all of the new systems to communicate and share data with one another and with current systems. At least 34 million lines of software code will need to be generated—about twice the amount needed for the Joint Strike Fighter, DoD's largest software development effort to date.

The severity of the technological challenges associated with developing all 18 FCS components and the network that would tie them together has already led to increases in the time and funds allotted to FCS development. As first described by General Shinseki in October 1999 and according to the schedule in place as of November 2002, the program would have included a relatively short (three years) SDD phase starting in the spring of 2003, with all 18 systems slated to enter production by 2006 and to start initial fielding in 2008. Since then, more than eight years has been added to the development phase, and the first unit to be equipped with all 18 systems will not be fielded until 2015 at the earliest.

Program Costs. Funding for the FCS program will represent a significant portion of the Army's procurement and R&D budgets for the next 20 or more years. The program will require $8 billion to $10 billion annually—under the assumption of no growth in costs—starting in 2015, when the Army is scheduled to begin buying 1.5 brigades' worth of equipment each year. During the preceding five years, the program will have consumed increasingly larger shares of the Army's investment budget (the combined research, development, test, and evaluation (RDT&E) and procurement accounts). If the Army's investment budget grew after 2011 at a rate equal to that of inflation, the FCS program's share would rise from 11 percent of the service's planned $30 billion investment budget in 2010 to 36 percent by 2015; from then until 2025, its share would remain at about 30 percent. Dedicating such a large proportion of the Army's investment funding to the FCS program would leave little money for purchasing other weapon systems, such as helicopters, or needed support equipment, such as generators and ammunition.

Another concern is that the FCS program has already experienced significant cost growth since it entered the SDD phase in spring 2003. At that time, the program's total acquisition cost for 15 brigades—including RDT&E and procurement—was

5. A fully mature technology, in GAO's definition, is one that has been demonstrated in a prototype in an operational environment. The April 2005 independent assessment (Office of the Deputy Assistant Secretary of the Army for Research and Technology, *Technology Readiness Assessment Update*) was cited in the statement of Paul L. Francis, Director, Acquisition and Sourcing Management, before the Subcommittee on AirLand of the Senate Committee on Armed Services, *Business Case and Business Arrangements Key for Future Combat System's Success*, published as Government Accountability Office, *Defense Acquisitions: Business Case and Business Arrangements Key for Future Combat System's Success*, GAO-06-478T (March 1, 2006).

projected to be about $80 billion. DoD's latest estimate of that cost has increased to $130 billion, or roughly 60 percent more than its original estimate.[6] And if the history of the Army's major weapons programs is any indication, the costs of the FCS program may continue to grow. Historical trends indicate that such programs experience growth in R&D costs ranging from 30 percent to 71 percent and growth in procurement costs ranging from 13 percent to 74 percent—as measured from estimates of costs prepared when programs enter the SDD phase. (The higher end of the range reflects historical cost growth for ground vehicles.)

Overall, the different types of equipment that the FCS program plans to develop lead CBO to estimate that its acquisition costs could grow by about 60 percent. Given some defense experts' view that the program's entry into the SDD phase was premature, it is possible that the FCS program will continue to experience cost growth at historical rates. CBO estimates that such high rates may push the average annual funding needed for the FCS program from the $8 billion to $10 billion projected most recently by the Army to between $14 billion and $16 billion.

The Age of the Army's Armored Vehicle Fleet. The total size of the FCS program—in terms of brigades' worth of equipment purchased—and the rate at which the program is executed will determine how many of the Army's current armored vehicles must be retained and for how long. At the end of 2005, the Army had an armored vehicle fleet of more than 29,000 vehicles, including 5,300 Abrams tanks, 6,400 Bradley fighting vehicles, 16,000 vehicles based on the M113 personnel carrier, and 1,400 155-millimeter self-propelled howitzers. Those vehicles, and the armored combat fleet as a whole, are aging. M113-based vehicles, which constitute more than half of the Army's armored combat vehicles, were first introduced into its units in the 1960s. Most of the rest of the service's armored vehicles—namely, the Abrams tanks and Bradley fighting vehicles—are based on technology that is roughly 20 years newer. But even those vehicles (which have undergone several upgrades since they were first produced) at the end of 2005 had average ages of 13 and 10 years, respectively. The useful lives of armored vehicles can be from 20 to 30 years. Thus, many of the vehicles that provide much of the current Army's combat power could reach the end of their useful lives in the next decade—unless DoD invests significant sums in upgrading or modifying them.

The Army is currently reorganizing its fighting forces under what is known as its "modularity" initiative. That reorganization, which will reduce both the size of armored units and the total number of those units in the Army (active-duty and National Guard combined), means that the service will need fewer armored vehicles and might allow it to retire more than 14,500 of its oldest armored vehicles by 2011. Those retirements would yield an armored fleet in that year that would be younger than the fleet would have been without the extensive retirements. Never-

6. In DoD's latest estimate, total funding for the FCS program would span the years from 2003 through 2044.

theless, the resultant fleet, with an average age of 15 years, would still be relatively old.

Although the FCS program could ultimately replace most of the armored vehicles that currently equip the Army's combat brigades, the average age of those vehicles would significantly exceed the Army's guidelines before they were retired. FCS vehicles will not begin to enter the active fleet until 2015 at the earliest. By the time the Army begins to field significant numbers of FCS vehicles—roughly 500 per year starting in 2018—the average age of the fleet will be more than 17 years (see Figure 2). Because the proposed annual purchases of armored vehicles under the FCS program represent only 3 percent of the total fleet, they will not begin to reduce the fleet's average age until 2024. Even then, the average age could exceed 15 years—the high end of what the Army considers the desirable range—for the foreseeable future. If the Army continues to purchase FCS vehicles after the first 15 brigades' worth have been bought, armored vehicles in the combat brigades and prepositioned sets (brigade-sized sets of equipment that the Department of Defense has prepositioned and maintains in several locations around the world) will have been totally replaced by FCS vehicles by 2038.[7] Until then, however, the Army's current armored vehicles will need to be maintained in fighting condition.

The Army aims to maintain the average age of its armored vehicles at or below half of their useful life by continually upgrading them to reflect the capabilities of the latest models and by incorporating FCS technologies into them when the new systems become available.[8] To that end, the President's 2007 budget requested almost $3 billion from 2007 through 2011 for upgrades to Abrams tanks, Bradley fighting vehicles, and M113-based vehicles. CBO estimates that in order to continue those upgrades, pay for upgrades to the Army's M109 howitzers, and keep the average age of the required fleet relatively constant after 2011, the Army must invest an additional $21 billion from 2012 to 2025.[9] That investment could bring the average age of the Army's required fleet of combat vehicles down from one that without upgrades would approach 18 years in 2020 to one that would remain consistently below 14 years (see Figure 2).

---

7. Some M113-based vehicles and self-propelled howitzers that equip units other than combat brigades would be retained indefinitely.

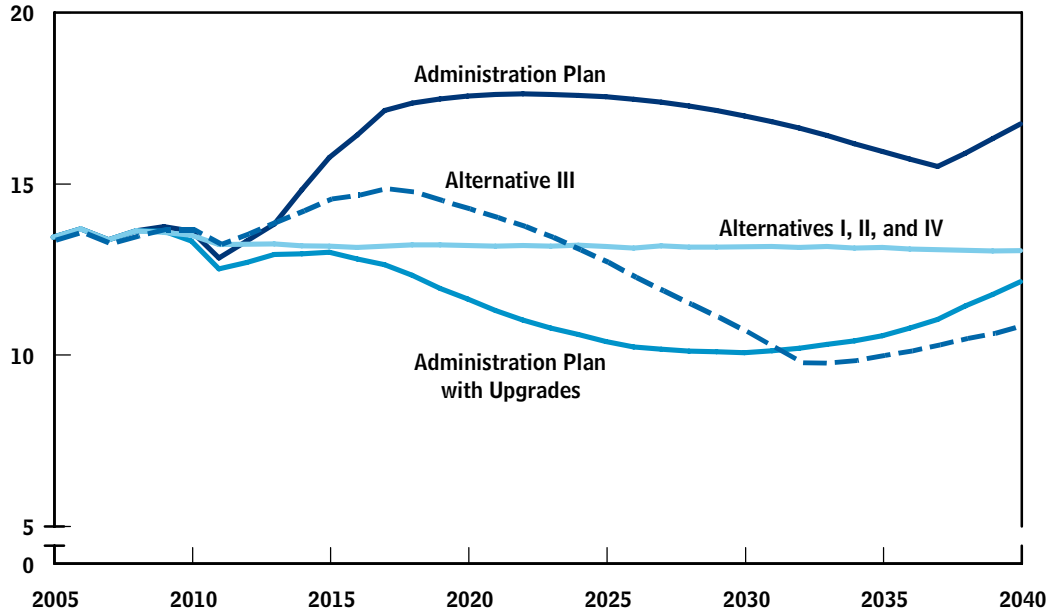
8. The Army's goal is to upgrade enough armored vehicles so that it can equip all of its heavy combat brigades and prepositioned sets with the A2SEP and AIM models of its Abrams tanks, the A2ODS and A3 models of its Bradley fighting vehicles, and the A3 version of its M113-based vehicles.

9. In developing that estimate, CBO assumed that in addition to incorporating systems that provided new capabilities, including some of those associated with the FCS network, an upgrade to an existing vehicle would also replace all components (such as engines and transmissions) needed to reset the vehicle's effective age to zero.

Figure 2.

Effect of Alternatives on the Average Age of the Army's Armored Combat Vehicle Fleet

(Average age in years)



Source: Congressional Budget Office.

Note: The armored combat vehicle fleet includes Abrams tanks, Bradley fighting vehicles, M113-based vehicles, M109 self-propelled howitzers, and all proposed manned vehicles in the Future Combat Systems program.

Alternative I would emphasize information collection and sharing;

Alternative II would emphasize long-range strike missions;

Alternative III would emphasize new vehicular technology; and

Alternative IV would cancel all vehicles, munitions, sensors, and missile launchers in the Future Combat Systems program.

Deployability of Army Units. Although a major impetus behind the FCS program was the Army leadership's desire to make units equipped with armored vehicles easier to deploy overseas, the current plan to replace the Army's armored vehicle fleet with FCS vehicles will not significantly reduce deployment time. Whether equipped with current or FCS components, the Army's heavy units comprise hundreds of tracked vehicles and hundreds more trucks and trailers (see Table 2). Deploying such units by air requires hundreds of aircraft sorties. Yet the lack of extensive paved surfaces for receiving and unloading aircraft at most airfields in the world (excluding large U.S. military facilities such as those in Germany and South Korea) limits the number of daily sorties by Air Force transport aircraft that those airfields can support. For example, each C-17 transport plane can carry less than 0.3 percent of a brigade equipped with armored vehicles over long distances. As a

Table 2.

Comparison of Combat Brigades Equipped with Current and FCS Armored Vehicles

	Brigade with Current Vehicles	Brigade with FCS Components
Personnel	3,700	3,300
Approximate Number of Vehicles and Other Equipment		
Tracked vehicles	370	320
Trucks, trailers, and other vehicles[a]	1,250	920
Total vehicles	1,620	1,240
Total weight (Tons)	20,800	15,500
Total area covered (Thousands of square feet)	300	220
Total Weight of All Brigade Equipment (Tons)	25,000	18,700
Total Coverage of All Brigade Equipment (Thousands of square feet)	320	240
C-17 Sorties Needed to Deploy the Brigade[b]	410	340 to 380
Sealift Ships Needed to Deploy Equipment		
Fast sealift ships[c]	2	2
Large medium-speed roll-on/roll-off ships[c]	1	1

Source: Congressional Budget Office based on data from the Department of the Army; Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide: Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001); and Department of the Air Force, *Air Mobility Planning Factors*, Pamphlet 10-1403 (December 18, 2003).

Notes: The "brigade with current vehicles" is a modular heavy brigade.

FCS = Future Combat Systems.

a. "Other vehicles" include wheeled vehicles that cannot drive for long distances on roads and the 20 helicopters and 150 unmanned ground vehicles in the FCS brigade.

b. Based on an average load of 60 tons for current equipment and 50 tons to 55 tons for FCS systems.

c. Either fast sealift ships or large medium-speed roll-on/roll-off ships will be needed, not both.

result, limiting the number of aircraft sorties in turn limits the amount of equipment that can be delivered overseas in one day during the initial surge (the first 45 days) of a military operation to about 5 percent of a heavy brigade or 1 percent of a heavy division.[10] After the first 45 days, even less cargo is likely to be delivered daily. CBO estimates that given those constraints, transporting a brigade equipped with the Army's current armored vehicles overseas by air might take 23 days; moving an entire division similarly equipped might take more than four months (see Table 3).[11]

10. Division-sized units include four combat brigades as well as headquarters and other support units.

11. CBO used as an example the transport of Army units from the United States to Djibouti on the east coast of Africa to illustrate the trade-offs involved in moving units overseas.

Table 3.

Comparison of Time Needed to Deploy Brigade- and Division-Sized Units from the United States to East Africa

		Days to Deploy Brigade-Sized Units		Days to Deploy Division-Sized Units[a]	
		Airlift[b]	Sealift	Airlift[b]	Sealift
		Administration Plan			
Modular Heavy Brigade with Current Vehicles		23	23	135	27
FCS-Equipped Brigade[c]		19 to 20	23	115 to 130	23
		Alternatives			
Alternative I.	Emphasize Information Collection and Sharing	23	23	140	27
Alternative II.	Emphasize the Long-Range Strike Mission	24	23	140	27
Alternative III.	Emphasize New Vehicular Technology	24	23	145	27
Alternative IV.	Cancel the FCS Program	23	23	135	27

Source: Congressional Budget Office based on data from the Department of the Army; Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide; Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001); and Department of the Air Force, *Air Mobility Planning Factors*, Pamphlet 10-1403 (December 18, 2003).

Note: FCS = Future Combat Systems.

a. Division-sized units include four combat brigades as well as headquarters and other support units.

b. The number of daily airlift sorties is constrained by the capacity of the airfield in East Africa.

c. Based on an average airlift payload of 50 tons to 55 tons.

In contrast, seagoing ships can easily transport very large amounts of the Army's current equipment. Indeed, one or two of the U.S. Military Sealift Command's (MSC's) large seagoing ships can transport an entire brigade's worth of equipment, and eight of those vessels can transport an entire division overseas. Most coastal regions of the world have at least one large port capable of receiving MSC's ships. And even though some of the equipment associated with a heavy division might have to be loaded onto some of the command's slower ships, it would still take far less time to deliver a full heavy division by sea—27 days—than it would take by air.

Replacing the Army's current armored vehicles with FCS vehicles does not tip the balance in favor of airlifting those systems. In fact, it makes very little difference. To transport an FCS brigade by air using C-17 aircraft would require 340 to 380 sorties—a process that would take 19 or 20 days—to any overseas destination without an extremely large airport (see Table 3). That compares with the roughly 410 sorties needed to move a heavy brigade equipped with current systems. Thus, replacing the Army's current fleet of tracked vehicles with FCS components would yield at most a 17 percent reduction in the airlift sorties (and time) needed to deploy a heavy brigade-sized unit overseas. Because brigade-sized units are rarely deployed alone, however, it is useful to examine the time needed to deploy larger formations, such as divisions. A division equipped with FCS vehicles could weigh roughly 20 percent less than a heavy division equipped with current armored vehicles—95,000 tons compared with 120,000 tons. Even so, transporting such a division overseas by air would take at least 115 days. Transport by sea could be accomplished solely by the MSC's fastest sealift ships and would require 23 days rather than the 27 days needed to transport a similar division equipped with current vehicles (see Table 3).

Survivability. Finally, several observers have questioned the basic assumption that underlies the survivability of the lightweight FCS vehicles. The Army argues those lightly armored vehicles will be able to survive on the battlefield because they will have extensive knowledge of the enemy's whereabouts, which will allow them to avoid unexpected or disadvantageous encounters with enemy forces. If, however, the FCS sensors and communications network do not work as planned, the ability to avoid such encounters and thus the survivability of FCS lightly armored vehicles are uncertain. Moreover, other people, including soldiers returning from duty in Iraq, have argued that the most sophisticated sensors will not be able to detect and predict the kinds of dangerous situations that are now prevalent there.

Alternative Approaches for Modernizing the Army's Heavy Forces

CBO has analyzed four different approaches for modernizing the Army's armored units that would address major concerns raised about the FCS program—specifically, its technical feasibility, its cost, and the slow rate of introduction of its sys-

tems into the Army's force structure. Under three of those alternatives (I, II, and III), the Army would retain different portions of the FCS program (to emphasize systems that would contribute to different transformational strategies) while canceling the remainder:

- Under Alternative I, the Army would go forward with developing and purchasing the full suite of sensors in the FCS program (to provide enhanced information-collection capabilities) and a version of the FCS network (to disseminate that information).

- Under Alternative II, the Army, in addition to developing and purchasing a scaled-down version of the FCS network, would emphasize those of the program's systems that would enhance the Army's ability to attack targets at ranges of greater than 20 km.

- Under Alternative III, the service would focus, first, on enhancing the maneuvering ability of the Army's combat brigades by developing several of the FCS manned ground vehicles—particularly those that would replace the older M113-based vehicles and M109 howitzers currently in the fleet—and, second, on developing and purchasing a modified version of the network to tie them together.

Under the last alternative (Alternative IV), the Army would essentially cancel the FCS program but would—as under the other three alternatives—develop a scaled-down network. Under none of the alternatives would the service develop or procure the unmanned ground vehicles or improved munitions systems that are currently planned under the FCS program, and all of the alternatives would upgrade existing armored vehicles to convert them to the latest model of the current system and prevent their average age from increasing. Such upgrades would also integrate the capabilities associated with the retained FCS components when the systems became available (see Table 4).

Alternative I. Develop and Procure FCS Systems That Would Collect and Disseminate Information

Under the first alternative, the Army would retain only those portions of the FCS program that would enhance the service's ability to collect information about the location of enemy and friendly forces and to disseminate that information to the soldiers in its combat brigades. With greater knowledge about the location and character of potential threats and the whereabouts of friendly forces, Army units, some argue, would be better able to respond and act appropriately, either individually or in concert. To collect as much information as possible, the Army under this alternative would develop and procure the unattended ground sensors and all four classes of unmanned aerial vehicles included in the FCS program. It would also develop a less ambitious and less extensive version of the FCS network and install it in existing armored vehicles so that they could receive and exchange the infor-

Table 4.

Emphasis of and Systems Included in Alternatives

Alternative	Emphasis	FCS Systems	
		Retained	Canceled
Alternative I	Information collection and sharing	Scaled-down network UAVs Classes I, II, III, and IV Unattended ground sensors	Manned vehicles (All) Unmanned ground vehicles (All) Non-line-of-sight launch system Improved munitions systems
Alternative II	Long-range strike mission	Scaled-down network UAVs classes III and IV Unattended ground sensors Non-line-of-sight launch system	Manned vehicles (All) UAVs classes I and II Unmanned ground vehicles (All) Improved munitions systems
Alternative III	New vehicular technology	Scaled-down network Manned vehicles Medical Infantry carrier[a] Non-line-of-sight mortar Non-line-of-sight cannon Command and control	Unmanned ground vehicles (All) Manned vehicles Mounted combat system FCS recovery and maintenance Reconnaissance and surveillance UAVs classes I, II, III, and IV Non-line-of-sight launch system Unattended ground sensors Improved munitions systems
Alternative IV	Current systems	Scaled-down network	Manned vehicles (All) Unmanned ground vehicles (All) UAVs Classes I ,II, III, and IV Unattended ground sensors Non-line-of-sight launch system Improved munitions systems

Source: Congressional Budget Office.

Note: UAV = unmanned aerial vehicle; FCS = Future Combat Systems.

a. Under Alternative III, the Army would buy roughly 25 percent of the infantry carrier vehicles included in the Administration's Plan.

mation collected by the FCS sensors. All other FCS systems, including the manned and unmanned ground vehicles, the non-line-of-sight launch system, and the improved munitions system, would be canceled.

CBO estimates that total costs under this alternative—without taking historical cost growth into account—would be $99 billion from 2007 through 2025, which is substantially less than the corresponding $139 billion in costs for the full FCS program for the same period. (However, costs for this alternative could reach $132 billion if costs grew as they have in the past for similar defense systems.) Costs for the FCS components developed and purchased under this alternative would be $60 billion from 2007 through 2025, in CBO's estimation; costs for upgrading the existing armored vehicle fleet would be $39 billion for the same period (see Table 5). Annual costs to implement Alternative I, which are just under $6 billion after 2015, would include about $2 billion to upgrade roughly 500 to 600 vehicles per year (see Figure 1).

One of the advantages of Alternative I is that under such an approach, the Army could introduce new technology into its units more rapidly than it could under the Administration's plan and at a lower cost. Because the service would be pursuing some of the least technologically risky FCS hardware components, it could begin to introduce them starting in 2010. And because those systems are also the least expensive of the 18 new systems, the Army would purchase them at rates twice as high as the Administration's planned 1.5 brigades' worth per year—that is, it would purchase 33 brigades' worth of the FCS sensors and UAVs and the network by 2025. And besides lower total costs under this alternative compared with those under the Administration's plan, cost growth would probably also be less, CBO estimates—33 percent compared with roughly 60 percent under the Administration's plan. Although with this alternative the Army would incorporate some of the capabilities for sharing information to be provided by the FCS network, it would not be as dependent on those capabilities to achieve survivability as it would be under the Administration's plan.

The deployability of Army units would be little affected under this alternative because the current armored vehicles in the service's heavy units would be retained. Indeed, if the alternative was implemented, the weight of a typical heavy brigade would increase slightly because additional trucks would be needed to support and transport the large number of UAVs that would be added to each brigade. As a consequence, the total weight of a heavy brigade might increase slightly, which would add half a day to the time needed to airlift the brigade overseas. If transported by sea, however, the additional vehicles would not affect the time required to deploy a brigade- or division-sized unit, because the additional vehicles and supporting gear would fit easily on the ships used to move similar units with current equipment (see Table 3).

When compared with the Administration's plan, this alternative suffers from several disadvantages. If it was implemented, the Army would retain its current

Table 5.

Costs from 2007 to 2025 for the Administration's Plan and Alternatives Reviewed by CBO

(Billions of 2006 Dollars)

	Research and Development	Procurement	Total Acquisition
		Administration Plan	
FCS Program Increment I[a]	21	101	122
Additional purchases, 2023 to 2025	0	17	17
CBO's Estimate of Upgrades to Current Systems Needed Under the Administration's Plan[c]	2	24[b]	26
Total	23	142	165
	Alternative I. Emphasize Information Collection and Sharing		
FCS Systems[d]	14	46	60
Upgrades to Current Systems[c]	2	37	39
Total	17	82	99
	Alternative II. Empahsize the Long-Range Strike Mission		
FCS Systems[e]	15	52	67
Upgrades to Current Systems[c]	2	37	39
Total	17	89	106
	Alternative III. Emphasize New Vehicular Technology		
FCS Systems[f]	16	52	67
Upgrades to Current Systems[c]	2	34	36
Total	17	86	103
	Alternative IV. Cancel the FCS Program		
FCS Network	14	16	30
Upgrades to Current Systems[c]	2	37	39
Total	16	53	69

Source: Congressional Budget Office based on data from the Department of the Army.

Note: The estimated costs presented in this table do not take into account the possibility of costs growing as they have in similar defense programs in the past.

a. Includes costs to develop and purchase the first 15 brigades' worth of FCS components—enough to equip slightly more than half of the Army's planned 27 heavy brigades (19 brigades in the active Army and eight brigades in the National Guard).

b. Includes roughly $3 billion requested in the President's 2007 budget for 2007 thorough 2011 to upgrade Abrams tanks, Bradley fighting vehicles, and M113-based vehicles.

c. Includes upgrades to Abrams tanks, Bradley fighting vehicles, M113-based vehicles, and M109 howitzers to maintain a relatively constant average age for each fleet of vehicles after 2011.

d. Includes unattended ground sensors, unmanned aerial vehicles (Classes I, II, III, and IV), and the network.

e. Includes unattended ground sensors, unmanned aerial vehicles (Classes III and IV), non-line-of-sight launch systems, and the network.

f. Includes manned vehicles (command and control, medical, non-line-of-sight mortar, non-line-of-sight cannon, and infantry carrier) and the network.

armored vehicles indefinitely. And even though it would invest $39 billion to upgrade them, by 2040, some of those vehicles would have been in the Army's inventory for almost 60 years. Another disadvantage is the technical risk involved in introducing network technology and associated communications links into old weapon systems, such as the Abrams tanks and Bradley fighting vehicles. Previous attempts to upgrade the communications and other electronic suites in those vehicles have met with difficulties.

Alternative II. Develop and Procure FCS Systems That Would Enhance the Army's Long-Range Strike Capability

Under the second alternative, the Army would retain those portions of the FCS program that would enhance its long-range strike capability. Specifically, it would develop and procure the unattended ground sensors and the longer-range UAVs—Classes III and IV—to detect and track targets. It would also develop and procure the non-line-of-sight launch system and its associated missiles to attack identified targets. The combination of the long-range UAVs and the missiles developed for the launch system would allow a brigade that was equipped with those weapons to identify and attack targets as far away as 70 km—long before most enemy weapons would be capable of striking the corresponding U.S. targets. All of the ground vehicles in the FCS program, both manned and unmanned, would be canceled under this alternative, as would the shorter-range—Classes I and II—UAVs and the improved munitions systems (see Table 4). In addition, the Army would retain and upgrade current armored vehicles and develop and procure a scaled-down version of the FCS network (to tie the sensors and manned systems together).

Like the previous alternative, which emphasized information gathering and dissemination, Alternative II would encompass the development and procurement of some of the least expensive of the FCS components. As a result, annual procurement rates could be higher than those planned by the Administration, and annual savings—relative to the Administration's plan—could still be achieved. Specifically, the Army under this alternative would buy three brigades' worth of sensors, missile launchers, and network hardware annually starting in 2016 and continuing through 2025. Total costs for those systems would be $67 billion from 2007 through 2025, CBO estimates (see Table 5). The costs to upgrade the Army's current armored vehicles would be identical to those in the previous alternative—$39 billion—over the 2007-2025 period. All told, costs under this alternative would total $106 billion from 2007 through 2025—$7 billion more than costs under the previous alternative but considerably less than those under the Administration's plan. Annual costs to carry out this alternative would be roughly $6 billion to $7 billion (see Figure 1).

Compared with the Administration's plan, this alternative would increase the firepower of Army brigades sooner and at a lower cost. Because parts of the FCS program, primarily the high-risk ground vehicles, would be canceled under this alternative, costs would be $33 billion less from 2007 through 2025 relative to those

for the full FCS program; nevertheless, high-volume missile launchers would be introduced into a larger proportion (almost two-thirds) of the Army's combat brigades than would be introduced under the Administration's plan for the same period. The potential for cost growth under this alternative is also more favorable than under the Administration's plan—34 percent versus 60 percent. (If costs grew as they have in the past, acquisition costs under this alternative could be as high as $142 billion, compared with $224 billion for the full FCS program.) Because the Army would make a significant investment in upgrades under this approach, the resulting armored combat vehicle fleet would be significantly younger than the one that would result under the Administration's plan (see Figure 2). In addition, this alternative would achieve survivability through other means than depending on what could be a problematic network.

In emphasizing systems that would help the Army achieve better long-range strike capability, this alternative would not compare favorably with the Administration's plan on at least two counts. First, the Army's current armored vehicles that were originally designed in the 1970s or earlier would be retained indefinitely. Integrating those vehicles into a network that would tie them and the FCS sensors and launchers together might be difficult. Second, under this alternative, the weight and bulk of the Army's units would be increased because equipment (trucks to support the FCS UAVs and missile launchers) would be added to each brigade. As with the previous alternative, that would mean an increase—in this case, one day—in the time needed to deploy a heavy brigade by air but no increase in the time required to deploy by sea (see Table 3).

Alternative III. Emphasize Investment in New Manned Combat Vehicles

The third alternative envisions that the Army would develop and procure five types of manned vehicles in the FCS program to replace the oldest of its combat vehicles—the M113-based vehicles and M109 howitzers—which are currently assigned to combat brigades (see Table 4). The FCS vehicles would address at least some of the problems—such as the inability of the M109 howitzers to keep up with the newer Abrams and Bradley vehicles—that the Army has said are associated with keeping those older vehicles in combat units. The Army's other armored vehicles—the Abrams tanks and Bradley fighting vehicles and those M113-based vehicles and M109 howitzers in units outside of heavy combat brigades—would be retained and upgraded so that they could be integrated into a scaled-down FCS network, another element of this alternative. All other parts of the FCS program—specifically, all four classes of UAVs, all unmanned ground vehicles, the non-line-of-sight launch system, the unattended ground sensors, the improved munitions systems, and the remaining three types of manned FCS vehicles—would be canceled (see Table 4). Finally, under this alternative, the Army would procure only enough FCS infantry carrier vehicles (ICVs) to replace the M113-based personnel carriers in the combat brigades, resulting in a reduction of 75 percent in the size of the proposed ICV program.

CBO estimates that costs under this alternative will be similar to those under the previous two alternatives, requiring a total investment (excluding cost growth) of $103 billion from 2007 through 2025. Of that total, $67 billion would be needed to develop the five variants of manned vehicles and purchase 23 brigades' worth of equipment by 2025. Upgrading the current armored systems retained under this alternative would cost $36 billion from 2007 through 2025 (see Table 5).

Because the manned vehicles are among the most technically challenging of the FCS components and require the longest time to develop, purchases under this alternative would not begin until 2012. Consequently, the annual funding required would be less than that required under the previous two alternatives and the Administration's plan—until 2016 (see Figure 1). Thereafter, annual costs, at roughly $6 billion, would be slightly greater than those under the previous two alternatives but still significantly below those under the Administration's plan.

This alternative is unique among the approaches CBO considered in its introduction of new vehicular technology into the Army's forces. Because new armored combat vehicles would be introduced faster under this alternative than under any other—including the Administration's plan—some of the Army's oldest armored vehicles would be retired earlier and the average age of the resulting fleet would ultimately be the lowest (see Figure 2). The alternative's costs are on a par with those of the previous two alternatives and less than those of the Administration's plan. But because this alternative would emphasize the development and procurement of ground vehicles, which have experienced the highest rate of historical cost growth, the potential for such a rise in costs—at 56 percent—is greater than under the previous two alternatives and could add $58 billion to total costs.

This alternative shares some disadvantages with Alternatives I and II. Under this approach, the Army would retain indefinitely both the Abrams tank and Bradley fighting vehicle fleets—originally designed more than 30 years ago—and would attempt to incorporate the technology associated with the FCS network into those vehicles, a plan that could pose technical difficulties.

Implementing the alternative would have little effect on deployability. On average, FCS vehicles would replace about half of the armored vehicles in a heavy brigade; roughly 80 percent would be M113-based vehicles, which weigh less than the FCS vehicles replacing them. As a result, the total weight of a heavy brigade could increase by 5 percent under this alternative and in turn boost by one day the time it would take to deploy a brigade overseas by air. The alternative would not, however, increase the time required to deploy either a brigade- or a division-sized unit by sea (see Table 3).

Alternative IV. Cancel All Portions of the FCS Program Except the Network

The last alternative that CBO examined would preserve only that portion of the FCS program designed to develop and support the network (see Table 4). The new

capability—a scaled-down version of the network currently envisioned for the FCS program—would then be incorporated into existing armored vehicles. In that way, the capability of the Army's combat brigades would benefit from an evolutionary improvement rather than a wholesale makeover based on unproven technology. All other portions of the FCS program would be canceled.

Under Alternative IV, the Army would purchase the least amount of hardware, by comparison with the other alternatives, and incur the lowest costs—$69 billion from 2007 through 2025. CBO estimates that $30 billion of that total will be needed to develop and purchase the hardware for the FCS network and that costs to upgrade the Army's existing armored vehicles will be $39 billion (see Table 5). Some of the capabilities of the FCS network would be incorporated into the Army's current vehicles under this alternative, but the survivability of those vehicles would not be at risk if the network failed to perform as planned. Despite the fact that three brigades' worth of FCS network hardware would be purchased yearly starting in 2012, the annual funding needed to implement this alternative would be less than $4 billion in 2016 and thereafter (see Figure 1). Under this alternative, almost two-thirds of the Army's combat brigades would have upgraded network hardware by 2025. Moreover, because the Army would not develop or purchase any FCS components with high historical rates of cost growth, the potential for such growth would be relatively low—38 percent, or $26 billion.

The ability of Army units to deploy overseas would be unaffected under this alternative because no new weapon platforms would be added to existing Army combat brigades and no existing platforms would be replaced with new ones. The time needed to deploy a heavy brigade overseas by air or by sea would be the same as it is for brigades equipped with current armored vehicles—23 days. Similarly, there would be no change in the time needed to move a division-sized unit overseas by sea, which would remain at 27 days.

Because this alternative would call for so little investment in new technologies and equipment, it would also offer the fewest benefits, compared with the other approaches, from innovation. Even though upgrades would maintain the average age of the Army's armored vehicles at about 13 years through 2040 and the vehicles would be connected by a new network, they would still be the same armored vehicles that the Army has had for the past 20 years. And some of them—notably those based on the M113 chassis—have been in the Army's combat vehicle fleet since the Korean War.